protection alternatives
development concept plan/environmental asessment

CAPE HATTERAS LIGHTHOUSE COMPLEX

CAPE HATTERAS

NATIONAL SEASHORE • NORTH CAROLINA

protection alternatives
development concept plan
environmental assessment

draft

June 1989

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UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

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TABLE OF CONTENTS

SUMMARY 1

BACKGROUND 2

HISTORIC RESOURCES 4

NATURAL RESOURCES 7

DESCRIPTION OF ALTERNATIVES 13

ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES 30

CONSULTATION AND COORDINATION 41

PLANNING TEAM 42

APPENDIX: MEMORANDUM OF AGREEMENT 43

PUBLIC RESPONSE FORM FOR COMMENTS 45

ILLUSTRATIONS

Region v

Existing Site Conditions 5

Typical Barrier Island Cross Section 11

Alternative 1: Relocation 15

Proposed Site Plan 17

Existing Site Reclamation 21

Alternative 2: Seawall with Revetment 25

Alternative 3: Rehabilitation of Groinfield with Revetment 27

REGION

CAPE HATTERAS NATIONAL SEASHORE
U.S. Department of the Interior / National Park Service

DSC/July 1988/603-40,018E

0 10 20 30 miles
0 16 32 48 kilometers

N

SUMMARY

This report documents the National Park Service's (NPS) consideration to protect the Cape Hatteras lighthouse and associated structures from damage or destruction due to coastal processes. On the basis of past studies, and particularly that completed by the National Academy of Science (NAS) in 1987-88, the NPS preferred method of protecting the structures is by relocating them to an area approximately 2,500 feet southwest of their original locations and 1,600 feet from the shoreline. The report also describes other alternatives for protection and their environmental consequences, and presents concepts for interpretation, reclamation of the existing site, and development at the proposed site. All historic structures will be relocated into the same configuration relative to themselves and the coastline as now exists, and an eight-acre area will be maintained as open space to approximate the historic scene. Additional major development at the proposed site consists of toilet facilities and parking for 110 vehicles. Reclamation and new development at the existing site will consist of toilet facilities with exterior showers, parking for 120 vehicles, and pedestrian access for recreational beach users and for those wishing to visit remnants of the historic site. The estimated cost of the proposal, including associated new site development, existing site reclamation, and interpretation, is $8,775,000, including gross construction costs, and advance and project planning costs. There would be no further annual costs to protect the lighthouse complex from damage by ocean processes for at least 100 years. After appropriate testing to determine its condition, the existing groinfield may be rehabilitated to provide interim protection for the lighthouse for at least 2 years, while a decision is being made and implemented for long term protection. Emergency protection utilizing sandbags may also be required.

BACKGROUND

The protection of the Cape Hatteras Lighthouse against the forces of erosion has been an inevitable consequence of its existence since 1870. When constructed, the brick lighthouse enjoyed a cushion of terrestrial security. Today the structure stands but 150-300 feet (depending on weather and tidal conditions) from a constantly encroaching sea that threatens to destroy it. Although largely replaced by a lightship at the tip of Diamond Shoals and electronic navigation aids such as LORAN, the old lighthouse remains in operation and is historically significant because of its architectural design and its importance in the early commercial history of the nation. As such, the lighthouse complex, comprising the lighthouse, an oil house, and two keeper's quarters, is on the National Register of Historic Places.

The Cape Hatteras Lighthouse represents a time in our history when coastal shipping needed to be protected from running aground. As the tallest such structure in the United States, it has become a landmark evoking images of early sea navigators, lighthouse keepers, and a way of life long gone. Today it has come to signify North Carolina's Outer Banks and serves as a focal point drawing visitors by the thousands each year. As a symbol of past and present, of quiet strength and stability, the lighthouse has transcended generations. Its preservation will insure continuation of that tradition in the years ahead and will enable visitors to appreciate the role of the lighthouse in the coastal commerce of the nation.

Without action, the Cape Hatteras lighthouse will be lost to natural processes. The lighthouse stands so near the shoreline today that a severe storm could produce currents and waves that would undermine the structure. Erosion occurs on a daily basis, too, so that when coupled with a projected gradually rising sea level, its prognosis for surviving much beyond the turn of the century is doubtful. Past efforts to contain the erosion and preserve the lighthouse in its present location have only temporarily succeeded. These include artificial dune construction (1930s), construction of steel or concrete groins (1930s, 1960s), beach nourishment (1960s, 1970s), sandbag revetment, riprap, and landward sheetpile extension of southern groin (1960s-1980s), and placement of artificial seagrass (1980s). A severe storm early in 1980 prompted several emergency measures, including laying more rubble and placing sandbags along the eroding escarpment fronting the lighthouse while extending the southernmost groin landward.

Meantime, looking to long-term protection for the lighthouse complex, NPS officials considered various options, including relocation, revetment, and groinfield rehabilitation. The North Carolina Coastal Resources Commission initially found relocation preferable. In 1981, at the request of NPS, the U.S. Army Corps of Engineers analyzed two alternatives--construction of breakwaters and a southern terminal groin, and construction of a seawall with revetment. After further studies, in July, 1982, NPS endorsed the latter alternative. The North Carolina Coastal Resources Commission, recognizing potential cost and engineering difficulties with relocation, supported the seawall-revetment construction because it did not adversely affect natural processes or marine productivity.

In November, 1985, upon completion of a design study for the seawall/revetment by the Corps of Engineers, NPS announced its selection and intended implementation of the alternative. Before enactment of the decision, however, NPS, responding to the requests of various concerned individuals and organizations, agreed to seek consultation and advice regarding the several feasible alternatives, including relocation. In April, 1987,

NPS requested that the National Academy of Sciences (NAS) evaluate these proposals. That report, "Saving Cape Hatteras Lighthouse from the Sea: Options and Policy Implications," released in June, 1988, presented several preservation options, with three emerging as most feasible: incremental relocation, seawall with revetment, and rehabilitation of the groinfield with revetment. Of these, the NAS preferred option, incremental relocation--moving the lighthouse in sequences along a track--involved relocating it, first 400-600 feet southwest of its present position, to a site that would insure its protection for approximately twenty-five years. Later, as the need arose, the lighthouse could be moved farther back in the same direction. The NPS, seeking to guarantee 100 years of security for the lighthouse, and aware of the likelihood of rising costs affecting any future moves, recommends relocating the structure roughly 2,500 feet southwest of its present position to one closely corresponding to the NAS intermediate area. Based on known rates of shoreline retreat, this distance would insure its protection for at least 100 years. The other NAS alternatives (seawall with revetment and rehabilitation of the groinfield) would insure survival of the lighthouse for only 20-30 years and would require prohibitively expensive annual maintenance for protection beyond that time.

The NAS preferred option for relocation, along with other publicly and privately expressed interests, has precipitated this study of alternatives. Based on this study and the information provided by the NAS and others, NPS prefers relocation of the lighthouse subject to public response to this document and further engineering study to assure safe movement of the lighthouse without damage to its historic fabric.

The purpose of this document is to evaluate the environmental and other impacts of the alternatives associated with protecting the light station complex. Specific issues to be addressed are:

1. The potential loss of the lighthouse and associated structures.

2. The most effective alternative for saving the lighthouse and associated structures.

3. Risks bearing on moving the lighthouse and associated structures versus those concerned with leaving them in place.

4. Selection of an appropriate site for relocation of the historic complex.

5. Compliance of proposed actions with North Carolina coastal zone management regulations, federal historic preservation laws, State and Federal endangered and threatened species concerns, and NPS management policies.

6. Assessment of the impact of proposed actions on natural and cultural resources.

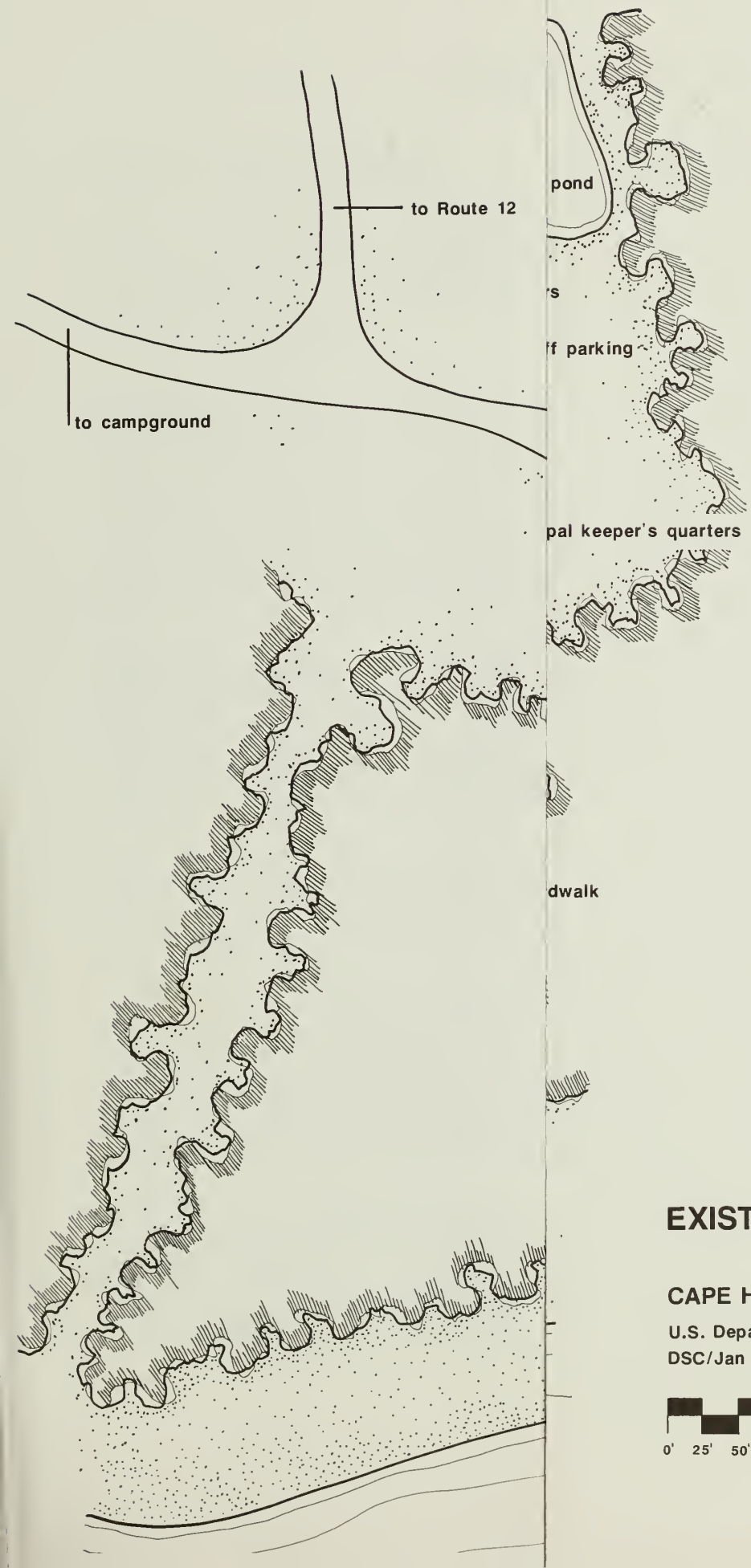
7. Separation of visitor use between the beach area and the light station complex area.

8. Cost.

HISTORIC RESOURCES

The historic light station complex consists of four buildings. The lighthouse, cornerstone of the complex, was completed in 1870, replacing an earlier structure located nearby, which was constructed in 1802 and has since been destroyed. Erected 1500 feet from the 1870 shoreline, the current lighthouse stands 208 feet high, weighs approximately 2800 tons, and was built of brick on a base of red granite. The structure rests on a pine timber mat within the fresh water table beneath the foundation. As the tallest lighthouse in North America, its beacon warned nighttime navigators away from the treacherous Diamond Shoals area, so-called "graveyard of the Atlantic," while its distinctive black-and-white spiral paint design served that function by day.

Near the north side of the lighthouse stands a brick oil house built in 1892 to contain the kerosene to fuel the beacon. (See Existing Site Conditions map.) The remaining two buildings and their accompanying cisterns are all that survive in the complex that once included several kitchen, storage, and toilet facilities. The principal keeper's quarters stands about 270 feet northwest of the lighthouse. Completed in 1871, the two-story L-shaped brick structure measures approximately 35 feet by 32 feet. The double keepers' quarters was erected in 1854 and was extended in 1892. Presently used as a park visitor center, the structure stands approximately 100 feet west of the principal keeper's quarters and measures about 86 feet long by 42 feet wide. In 1936 the U.S. Coast Guard, mindful of the constant shoreline erosion, raised a steel light tower at Buxton and turned administration of the lighthouse station complex over to NPS. Then in 1950, the Coast Guard resumed operation of the Cape Hatteras light under terms of a permit from NPS. The light continues in operation today.



EXISTING SITE CONDITIONS

CAPE HATTERAS NATIONAL SEASHORE

U.S. Department of the Interior/National Park Service
DSC/Jan 89/603-40,069

0' 25' 50' 100' 200'

EXISTING SITE CONDITIONS

CAPE HATTERAS NATIONAL SEASHORE

U.S. Department of the Interior/National Park Service
DSC/Jan 89/603-40,069

0' 25' 50' 100' 200'

NATURAL RESOURCES

BARRIER ISLAND DYNAMICS

The Cape Hatteras Lighthouse complex is located near the elbow of Hatteras Island, one of several barrier islands comprising the Outer Banks of North Carolina. By nature, barrier islands are continually being reshaped by waves, currents, and winds. Their long-term behavior depends primarily on the rate of sea level rise, sea energy, sand supply and human interference. The most dramatic natural changes occur during storms, which are periods of high energy.

Topographical changes of barrier islands occur as a result of longshore sand transport through the processes of longshore drift, inlet formation and closure, overwash and redistribution by wind and wave. Longshore currents move sand along the beach as waves strike the shoreline at an angle. Between 750,000 and 1,000,000 cubic yards of sediment per year are transported from north to south along the seashore. The groinfield fronting the lighthouse has been effective in trapping a portion of this material, thus retarding erosion in front of the lighthouse. The groinfield's interference with this natural sediment transport, however, has created a sediment deficit and increased erosion in the area immediately south of the lighthouse.

Overwash is important in barrier island dynamics. It is a process in which ocean water breaches, or overflows, the dunes and then deposits sediments on the barrier flat. This occurs from storm surge and wherever the dune system has been weakened either naturally or by man. Depending on the storm magnitude and island width, the overwash may extend into the marsh or lagoon. At Cape Hatteras National Seashore, overwash deposits are quickly colonized by buried grasslands as the plants push up through the new sand; this quick regrowth keeps wind erosion to a minimum.

It is this set of dynamic processes from ocean currents, waves, storm surges, and overwash that has eroded the shoreline and threatens the lighthouse. The greatest damage from overwash and flooding occurs when the factors of high spring tide and severe storm surge and storm waves are superimposed.

Fundamental to considering moving the light station complex for long-term protection is determining how far to move it from the shoreline. This requires a projection of coastal erosion rates to determine where the shoreline will be in 100 years, the time period for which NPS desires to protect the complex. Erosion rates are based on a number of factors, including rise in sea level, which tends to increase erosion, and the presence or absence of engineering structures that retard erosion, such as groins. The NAS committee believes that the most realistic projections of coastal erosion or shoreline retreat are based on trend analysis of past erosion rates.

One estimate of erosion rates under natural conditions, without groins, artificial dunes, or other protection measures, comes from the period between 1870 and 1919, when the shoreline decreased from 1,500 feet to 300 feet in front of the lighthouse--a distance of 1,200 feet over forty-nine years, for a rate of 24 feet per year. An estimate of erosion rates with groins in place comes from the period from 1945 to 1983, when the retreat rate was 5.2 feet per year, as reported by the U.S. Army Corps of Engineers.

The NAS study further suggests that the rate of sea level rise, which has been about .08 inch per year at Cape Hatteras, may accelerate in the future. Under four scenarios of various rates of sea level rise presented in the NAS document using such mitigative measures as groins, shoreline retreat over 100 years would total 525 feet, 1,260 feet, 2,260 feet, or 3,280 feet. In the absence of such mitigative measures, shoreline retreat over 100 years, according to NAS, would be 2,600 feet, 6,300 feet, 11,300 feet, or 16,400 feet.

HYDROLOGY AND WATER QUALITY

Groundwater provides the freshwater resources for the national seashore. Its source consists of a water-table aquifer and confined or semi-confined aquifers. In Buxton Woods, freshwater marshes and ponds occur in depressions between the forested dunes, in areas where the water table is above the ground surface. In the vicinity of the lighthouse relocation area, scattered soil depressions have produced ground levels approaching the seasonal high water table, thus creating patches of marsh vegetation, or "pocket wetlands." Compliance needs for impacting these areas are addressed in the accompanying Environmental Consequences section.

Given this hydrologic regime, there is potential for contamination of fresh groundwater if special care is not taken to insure protection, especially during construction activities and during treatment of wastewater and sewage. Wastewater effluent can enter the aquifer as easily as rainwater. In addition, withdrawal of freshwater causes brackish water levels to rise in the aquifer, with possible adverse effects on vegetation.

SOILS

The soils of the national seashore have been mapped and described by the U.S. Department of Agriculture, Soil Conservation Service. The soils are generally sandy, but marsh soils contain more organic material. The variation in topography is a major cause of the differences. All the soils present some limitations; therefore, any development project would require special engineering to overcome problems and extra caution to avoid environmental damage.

The Wilmington District, Corps of Engineers, has been contracted by the National Park Service to perform a subsurface investigation to determine if the soils would support the loads that would be applied en route during the move of the lighthouse. Ten borings were taken at intervals of 250 feet along the move route - seven borings to 30 feet deep and three borings to 54 feet deep. Findings indicate that moving the lighthouse is feasible with respect to soil bearing capacity along the move route. The study recommends that additional subsurface investigations be performed, including drilling and soil laboratory testing, to acquire additional geophysical data along the proposed move route and at the proposed lighthouse location. This information will be used to help determine the type of footing and foundation bearing surface needed to support the move track, and the lighthouse in its final location.

TOPOGRAPHY

Except for coastal beach dunes and scattered inland dunes, there is very little topographic variation within the vicinity of the lighthouse and along the move route. The elevation difference between the base of the lighthouse in its existing location and the proposed location is approximately 2 feet, from just under 8 feet to 10 feet above sea level. As part of the contract to investigate the subsurface, the Corps will produce a topographic map of the area at a scale of 1 inch to 50 feet, with a 1-foot contour interval.

ECOLOGICAL COMMUNITIES

Communities of specialized plant and animal species have adapted to the often harsh and unstable barrier island environment of Cape Hatteras National Seashore. Going from ocean to sound, the types of communities on a barrier island could be classified as beach, berm, dune field, grassland flats (or back dune), shrub thicket and marsh. The distance from the ocean, prevailing winds, soil salinity, moisture and overwash frequency are among the factors that determine this distribution of vegetation types and animal habitats associated with the different communities. (See Typical Barrier Island Cross Section graphic.)

Each of these communities' stability is sensitive to different types of disturbance. In the beach environs, tidal action washes away minor disturbances, but groinfields either deposit or take away sand at a faster rate than would naturally occur. The berm area, between the beach and dunefields, is sensitive, in relation to man's disturbing activities, to nesting animals (sea turtles and terns). Also, dunes that may try to form here are easily destroyed. Dunefields are extremely sensitive in that the plants hold the sand in place. These plants are highly susceptible to minor disturbances, and therefore are easily destroyed, causing erosion of the dunes. The grassland area is one of the areas on a barrier island where the water table is closest to the surface. This creates a situation where pollution of the water table is most likely to occur. Plants are sensitive to water level fluctuations, but this area is the most adaptive so far as natural recovery from overwash is concerned. Shrub thickets form in the more stable areas of the barrier islands, removed from frequent exposure to salt spray or overwash. The greater stability of these areas makes them suitable places for development. Typically, shrub thickets are densely vegetated, mainly with the wax myrtle, yaupon, red cedar and silverling and associated vines of poison ivy, greenbriar, and wild grape. Most of these plants are sensitive to salt spray. It is within the shrub thicket community that the proposed site occurs for the relocated lighthouse complex. The vegetation in the lighthouse relocation area is more open and more diverse than most thickets within the seashore, and ranges from loblolly pines, eastern red cedar, and scrub live oak in the higher elevations, to salt meadow hay (*Spartina patens*), black needle rush, and saw grass in the scattered, low "pocket wetlands" areas. (Buxton Woods, considered a maritime forest, will not be impacted by any of the alternatives discussed in this document. It should be noted, however, that the preferred alternative site is within 500 feet of the southeast edge of Buxton Woods.) The last environment, that closest to the sound, is the marshland. This area is vital to the esturine ecosystem in that it provides the highest level of nutrients for the lower food chain of the esturine system. Any type of disturbance here will have a monumental effect on the productivity of the estuary/sound.

PLANTS

Besides the beach, where algae are the only plants, vegetation is important in stabilizing the surface substrate of the barrier islands. Plants grow on the berm in driftlines, which serve as seedbeds. Dunes form in these berm areas as sand is trapped by plants. The presence of dune grasses, in particular, is critical in building and maintaining the dunefields. Certain plants, such as salt meadow cordgrass and pennywort, are adapted to overwash burial and will vigorously grow up through the sand. Thus, these plants have retained the ability to recover from overwash. The plant communities on and just behind the dunes are dominated by such species.

Shrub thickets will form where there is protection from salt spray and overwash, and have invaded some of the grasslands behind the dunes. On sites of higher elevation, maritime forests may occur, such as Buxton Woods. It is important that plants removed during construction are replaced to the greatest extent possible to hasten natural recovery and to prevent blowout.

ANIMALS

The animals and their habitats at the national seashore are described and highlighted on the Barrier Island Cross Section graphic, page 19. The most conspicuous animals are birds, which can be seen and heard in all habitats during all seasons.

About one-half of the mammal species that occur in North Carolina's lower coastal plain are found on the national seashore. Opossums, shrews, rabbits, rats, mice, voles, raccoons, and feral cats are among the land animals. Deer breed in Buxton Woods and have been seen within the area of the preferred alternative. Aquatic mammals such as muskrats, minks, nutrias, and otters are observed around ponds and marshes in Buxton Woods.

Land and freshwater reptiles – turtles, lizards and snakes – are found on the national seashore. Two species of poisonous snakes – cottonmouth and canebrake rattlesnakes – have been observed in Buxton Woods.

Fewer than a dozen species of amphibians – toads, frogs, and salamanders – are present, and they breed in freshwater ponds. Of these, Fowler's toads, squirrel tree frogs, green tree frogs, and southern leopard frogs are most widespread.

Mosquitoes and other biting insects are common in the grasslands, shrub thickets, and marshes.

Most of the animals discussed above could be found in the area of the preferred alternative site.

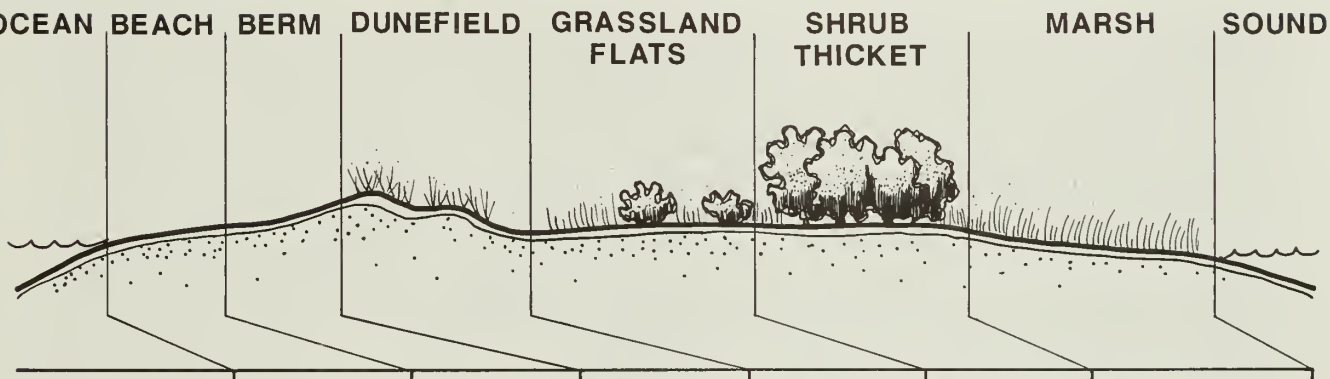
ENDANGERED AND THREATENED SPECIES

The following species listed as endangered or threatened under the Endangered Species Act of 1973 may occur in the national seashore. To date, none of these species are known to exist within the preferred alternative site, but as requested by the U.S. Fish

TYPICAL BARRIER ISLAND CROSS SECTION & APPROPRIATE VISITOR ACTIVITIES

CAPE HATTERAS NATIONAL SEASHORE/ NORTH CAROLINA

U.S. Department of the Interior/ National Park Service



	Beach	Foredune	Newhan	Duckston/Corolla	Fripp Corolla Duckston Newhan	Carteret Currituck
PHYSICAL DYNAMICS	Shifting substrate. Breaking waves.	Worked by storm waves.	Sand movement by wind & waves	Overwashed. Flooded by storm tides.	Stable & high land.	Mucky substrate. Flooded by tides.
SOILS						
DOMINANT VEGETATION		American Beachgrass Sea Oats Wild bean	Daisy Fleabane Seaside goldenrod Bitter panicum Salt meadow cordgrass Pennywort	Broom sedge Silverling Red cedar	Yaupon holly Salt marsh elder	Spike grass Black needlerush Salt marsh cordgrass
CONSPICUOUS ANIMALS						
Birds:	Sandpipers Sanderlings Plovers Terns Gulls Black Skimmers		Sparrows Snow geese Meadowlarks Mourning doves Ring-necked pheasant Mockingbirds Red-winged blackbirds Hawks Grackles		Herons Egrets Ibis Ducks	
Others:	Mollusks Crustaceans (crabs) Worms	Reptiles	Insects Mammals	Amphibians		
SENSITIVITIES	Tidal action washes away minor disturbances.	Nesting animals (loggerhead turtles & least terns) disturbed by man. Dunes forming here easily destroyed.	Plants easily destroyed, then erosion of sand.	High water table easily polluted. Plants sensitive to water-level change. Natural recovery from overwash.	Dense thicket. Maritime forest may develop. Plants sensitive to salt spray.	Vital in estuarine ecosystem.

and Wildlife Service and the National Marine Fisheries Service, the following is a list of those species:

Mammals
Manatee, West Indian (*Trichechus manatus*) – Endangered
Whale, finback (*Balaenoptera physalus*) – Endangered
Whale, humpback (*Megaptera novaeangliea*) – Endangered
Whale, right (*Balaena glacialis*) – Endangered
Whale, sei (*Balaenoptera borealis*) – Endangered
Whale, sperm (*Physeter catodon*) – Endangered

Birds
Falcon, Arctic peregrin (*Falco peregrinus tundrius*) – Threatened
Plover, piping (*Charadrius melodus*) – Threatened
Roseate tern (*Sterna dougalli dougalli*) – Endangered

Reptiles
Turtle, Kemp's (Atlantic) ridely (*Lepidochelys kempii*) – Endangered
Turtle, green (*Chelonia mydas*) – Threatened
Turtle, hawksbill (*Eretmochelys imbricata*) – Endangered
Turtle, leatherback (*Dermochelys coriacea*) – Endangered
Turtle, loggerhead (*Caretta caretta*) – Threatened

No federally listed plants, insects, crustaceans, mollusks, amphibians, nonmarine mammals, or fishes are known to exist within or adjacent to the national seashore. The shortnose sturgeon (Endangered – once known from Albemarle and Pamlico sounds) is today believed extirpated from North Carolina.

In addition, the American swallow-tail kite (*Elaanoides forficatus*) and the plant species Carolina lilaeopsis (*Lilaeopsis carolinensis*), although not now listed or officially proposed for listing as endangered or threatened, are under status review by the U.S. Fish and Wildlife Service. "Status Review" species are not legally protected under the Act, and are not subject to any of its provisions, including Section 7, until they are formally proposed or listed as threatened or endangered. These species may be listed in the future and at that time will be protected under the Endangered Species Act.

Other species found in the national seashore are of special concern within the state. These are identified in "Endangered and Threatened Plants and Animals of North Carolina" (Cooper et al, 1977). To date, only one plant species, *Trichostema novellia* (no common name), is in the process of being classified for state rare status. The move and new site location will impact this species.

DESCRIPTION OF ALTERNATIVES FOR PROTECTING THE LIGHT STATION COMPLEX

Certain actions will be common to all the alternatives. The existing groinfield will be studied and possibly rehabilitated to protect the lighthouse from a fifty-year storm for at least two years, while more permanent measures are planned, designed, and implemented. All structures will be documented to Historic American Building Survey (HABS) and Historic American Engineering Record (HAER) standards. Historic Structure Reports must be completed for all structures before action is taken for their preservation. An archeological testing program will be undertaken at the lighthouse complex to insure that significant archeological resources associated with prehistoric or historic use of the site are not lost as a consequence of implementation of the alternative.

ALTERNATIVE 1: RELOCATION (PREFERRED ALTERNATIVE)

Alternative 1 is to move the lighthouse approximately 2,500 feet in a southwesterly direction, to a spot that would be approximately 1,600 feet from the ocean shoreline. (See illustration for Alternative 1: Relocation.) The existing groinfield would be retained. Following any initial rehabilitation of the groin field for interim protection, there would be no further maintenance of the groins. According to the NAS study, the moving operation entails minimal risk, and technology for such operations is well established. Among other large and heavy structures that have been moved are a 12,000-ton fourteenth-century church, moved 2,400 feet in Czechoslovakia in 1975, and oil-related structures as tall as 200 feet and weighing up to 35,000 tons. The associated historic structures – the oil house and the two keepers' quarters – would also be moved and placed in the same relative configuration to the lighthouse and shoreline as currently exists. All necessary rehabilitation and reinforcement needed to assure the structural integrity of the lighthouse and associated structures for the move, will be completed prior to the move. The new site is expected to afford protection for the four structures from damage by oceanic overwash and shoreline erosion for at least 100 years. Estimated cost of moving all four structures, including site preparation, lighthouse repair and strengthening, rail/track construction, new foundation, move site restoration, insurance, contractor's profit, project planning and design, project supervision, and contingencies is $6,981,000 ($6,591,000 for the lighthouse and $390,000 for the two keepers' quarters and the oil house). The duration of the project, including engineering analysis and design, would be 12 to 15 months. No annual maintenance costs would be associated with protecting the lighthouse from oceanic processes in its new location. (Initial and annual maintenance costs for all alternatives to protect the historic structures are based on the 1988 NAS report, "Saving Cape Hatteras Lighthouse from the Sea.")

Various methods of lighthouse relocation will be proposed by prospective contractors, and the chosen method will be determined by NPS with technical assistance from a contracted cooperative park study unit or another agency. One feasible method of moving the lighthouse, as presented in the NAS study, is as follows: After needed reinforcement of the structure is accomplished, a series of needle beams would be inserted through the foundation of the lighthouse. The lighthouse would then be raised by hydraulic jacks and lowered onto rollers that rest on multiple horizontal steel rail beams, or tracks supported by pre-cast concrete piles. The entire lighthouse structure would be moved with hydraulic jacks along the tracks to its new site, where it would be placed on a newly constructed foundation, such as a pile-supported concrete mat.

The keepers' quarters and oil house would be moved using standard house moving techniques. The total time for the move, including engineering analysis, is estimated at 12 to 15 months. The actual move, including site preparation, would take approximately 3 to 6 months. Relocation should occur during the spring and summer months, when hurricanes and severe "northeastern" storms are least likely to occur. (For more detailed descriptions and evaluations of the options for preserving the lighthouse, the reader is referred to the NAS study.)

Provisions by which a structure may be moved are contained in NPS *Management Policies* (1988). Conditions applicable to the Cape Hatteras light station complex are: (1) that the decision to move the structures considers the effects of that movement on the structures, their current and proposed environments, as well as the archeological research potential of the structures and their sites; (2) that the structures cannot practically be preserved on their present site; and (3) that every effort be made to reestablish the structures' historical orientation, immediate setting, and general relationship to the environment. All of these conditions can be met in the case of the Cape Hatteras light station complex.

Development at Proposed Site

Prior to any ground disturbance at this new location an archeological inventory and evaluation may be needed since the relocation site is immediately to the north of a 1930s Civilian Conservation Corps (CCC) camp. Cursory walkover of the proposed area by an archeologist did not reveal remains from the CCC period, although remains are readily visible in the campsite.

The proposed site will receive the following treatment and contain the following development for visitor use, interpretation, and resources management. (See the Proposed Site Plan.) Approximately eight acres of land will be cleared of existing vegetation, graded with concern for surface water drainage, and planted with turf grasses to resemble the open scene at the current site. The existing stone wall surrounding the lighthouse at the current site will also be moved, and a wrought-iron fence will be placed on the wall to match the fence which formerly stood there. Fencing will also be provided around and between the double and principal keepers' quarters. A walkway, placed in historical configuration to the buildings, will provide visitor access throughout the cleared site to the four historic structures. The walkway will be of modern, but historically compatible, brick and will be of sufficient width and elevation to meet the requirements of visitation and handicapped access. A single-lane grass/concrete roadway with turnaround will provide service access to the rear of the keepers' quarters. The cleared area will be surrounded by a vegetated buffer of natural trees and shrubs.

A paved parking area will provide space for approximately 100 visitor vehicles, 10 staff and service vehicles, and bicycle parking. This will be connected to the cleared site by a concrete walkway winding through the natural vegetated buffer. The parking area will be screened from the lighthouse complex as much as possible by existing vegetation. A handicapped-accessible comfort station will be constructed along the connecting walkway near the parking area, and a drinking fountain and bench seating will be provided. A 24-foot-wide paved access road with bicycle path and 3-foot-wide paved shoulders will connect the parking area to the Cape Point campground road. Signs and wayside exhibits will provide information and interpretation. Through these exhibits and/or interpretive media in the double keeper's quarters, the visitor will understand that the

ALTERNATIVE 1
RELOCATION

CAPE HATTERAS NATIONAL SEASHORE

U.S. Department of the Interior/National Park Service
DSC/Jan 89/603-40,067

NOT TO SCALE

historic structures have been relocated, and that this site and its visual setting is different from the original site. (See sections on interpretive themes and media.)

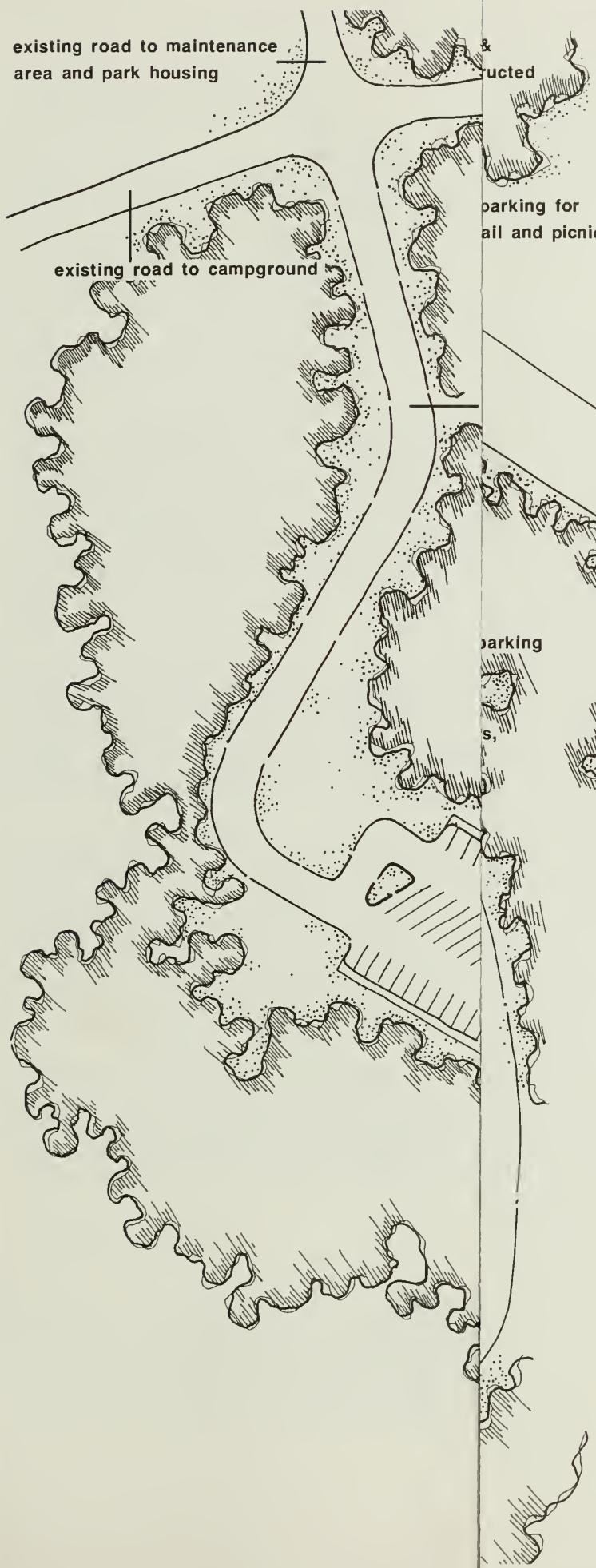
Both keepers' quarters will be elevated for protection from surface flooding and to be consistent with historical precedent. Those parts of the existing cisterns for each keeper's quarters that are visible above ground will be transferred to the new site. A restroom will be provided in the double keeper's quarters for staff use only, while a water fountain will be provided for public use.

Electric power will be provided to all four relocated structures and to the new comfort station. Potable water will be provided at the double keeper's quarters and the new comfort station. Sewage from these two structures will be handled by a septic-tank/leach field system. Telephone and radio communication will be provided at the double and principal keepers' quarters. Utility lines will be located to minimize destruction of natural vegetation. Telephone and electric power lines will be laid underground for aesthetic appearance and to protect the site from outages caused by frequent violent storms. Connection points to an existing power line, and to a new water main being constructed under a separate project, can be found approximately 350 feet north of the proposed location for the double keeper's quarters.

The entire complex of open space, parking, and connecting walkways and roadways will be located to minimize removal of major stands of trees and shrubs in the area. The complex will be wholly located to the east of the Cape Point campground access road, and will not intrude upon Buxton Woods.

All structures would be restored on the exterior to recommendations contained in existing and proposed NPS history reports. Any damage to the structures resulting from the move would be repaired. The interior of the double keeper's quarters would remain a visitor contact facility. The principal keeper's quarters would become a house museum based on a historic furnishings plan, and the oil house would be utilized for U.S. Coast Guard or park maintenance needs and would not be opened to the public. When restored, the lighthouse would be opened to visitation unless prohibited for safety reasons. Estimated development costs at the proposed site are $906,000, including planning and design, project supervision, and contingencies.

It is possible that restoration required to repair any damage to the structures resulting from the move will affect the eligibility of the complex to be listed on the National Register of Historic Places. Therefore, after the light station complex has been moved to the proposed site, NPS will seek the advice of the North Carolina State Historic Preservation Officer to determine whether the historic structures would still meet eligibility requirements. The proposed new location and setting must be reviewed by the Keeper of the National Register as required in 36 CFR, Part 60.14(b). If the structures are no longer to be eligible, NPS will proceed to have the complex delisted. If the structures remain eligible, NPS will amend the National Register form to reflect the move and describe them at their new location.



NOTES

- provide water and sewage disposal (septic tank/leach field) to parking lot comfort station, and double keepers quarters.
- provide electric power to all structures. lay utilities along newly disturbed area within historic zone and along entrance path.
- comfort station with outdoor bench seating and handicapped access, utility closet and water fountain.
- provide informational and interpretive signing and wayside exhibits.
- provide fencing around and between both keepers quarters.
- historic structures are relocated in same locations relative to each other and the shoreline as existed prior to relocation.

PROPOSED SITE PLAN

CAPE HATTERAS NATIONAL SEASHORE

U.S. Department of the Interior/National Park Service
DSC/MAY 89/603-40,068A

0' 25' 50' 100' 200'

existing road to maintenance area and park housing

existing road to campground

connect to existing power line & to new water main to be constructed under separate project

to existing site

existing parking for nature trail and picnic area

paved entrance road 24' wide with 3' wide shoulders plus bicycle path

major stands of mature trees are preserved

leach field

double keepers quarters with restroom for staff use. include cisterns. raise structure above ground surface to relate to historic siting.

Grasscrete service access. single lane.

turn-a-round no long term parking

principal keepers quarters, include cistern

paved parking 100 visitor spaces 10 spaces for staff and service

bicycle parking

handicapped parking

historic management zone for relocation of four historic structures

brick walkway

comfort station

oil house

access point for service vehicles

brick walkway within stone circle

reconstruct wrought iron fence onto stone wall

lighthouse

8 acres of existing vegetation to be cleared and planted with turf grass. site will require rough grading to give the appearance of the original lighthouse site's condition, and to allow for oil site drainage.

NOTES

- provide water and sewage disposal (septic tank/leach field) to parking lot comfort station, and double keepers quarters.
- provide electric power to all structures. lay utilities along newly disturbed area within historic zone and along entrance path.
- comfort station with outdoor bench seating and handicapped access, utility closet and water fountain.
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- historic structures are relocated in same locations relative to each other and the shoreline as existed prior to relocation.

PROPOSED SITE PLAN

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U.S. Department of the Interior/National Park Service
DSC/MAY 89/603-40,068A

0' 25' 50' 100' 200'

Reclamation of Existing Site

Following the move of the four historic structures, the existing groinfield will remain in place. Vestige foundations remaining on site will be protected from damage by visitors and will be interpreted. (See the Existing Site Reclamation plan.) Such protection could include fencing or covering the foundations to keep visitors off the ruins, actions that are also advisable from the standpoint of visitor safety. Archeological and historic documentation will be completed as necessary before loss of the foundations. Beyond this, no action will be taken to prevent the foundations from eroding into the ocean or from melting into the landscape. The remainder of the site will then continue to serve primarily as a major access point to the ocean and beach for recreational use.

Visitors to the lighthouse and keepers' quarters currently compete with beach recreational visitors for parking in the existing lot, which is inadequate and frequently full. Furthermore, the lighthouse move will destroy one section of the existing parking lot. Therefore, the parking area will be redesigned and enlarged to accommodate 120 vehicles. Expansion will not occur eastward toward the ocean or westward toward the freshwater pond, but will occur southward into the disturbed area created by the lighthouse track swath. Redesign will incorporate proper drainage for the site, and should be such that no runoff from the paved area will drain directly into the adjacent pond.

The two existing boardwalks to the beach will remain. The northern one will be made handicapped-accessible and will lead to a platform on the primary dune. The southern one is already handicapped-accessible and will remain so. A handicapped-accessible comfort station with exterior showers and a drinking fountain will be provided. Shower design should encourage quick showers, so as to avoid excessive water use, to minimize dirty water feeding into the sewage system and to reduce the temptation to loiter.

A concrete walkway will connect together the four historic foundations, the two boardwalks, and the shower facility and parking area. The existing service road to the rear of the keepers' quarters will be obliterated. The open grassy area will remain mowed and open. Information and interpretive exhibits will be provided, including those identifying the former sites of the four historic structures. A section of track on which the lighthouse is to be moved will remain for interpretation. Otherwise, the remainder of the track swath, as well as disturbed areas around the lighthouse foundation, will receive dune and vegetation restoration using endemic species.

Underground electric power and potable water will be provided to the new comfort station from power and water lines already on site. Existing overhead power lines will be placed underground, or removed if not needed. Sewage disposal will be provided by a septic tank and leach field. Estimated costs for reclamation of the existing site are $635,000, including planning and design, project supervision, and contingencies.

Interpretive Theme

From the standpoint of historic function, the location of a lighthouse a few hundred feet one way or the other is of no consequence. Strictly speaking, the proper view of it is from the sea, as seen by generations of sailors negotiating the most hazardous stretch of the Atlantic Coast. For land-dwellers, a lighthouse is a landmark or a romantic adornment more than a functional device.

During the passage of time, due to the installation and operation of the Diamond Shoals light, the value of Hatteras light has shifted primarily from function to symbol and aesthetic object. During the same period, however, feelings about the value of the light have also changed to the point where it now stands as a symbol of the state and region and is an attraction for seashore visitors.

Decisions made regarding this still-functional symbol will help establish a precedent that could affect other coastal historic resources and facilities. These decisions need to be based on sound data and good policy as well as on political realities.

Moving the Cape Hatteras light station complex is an application of appropriate technology. The structures will stand for many generations as proof that human needs can usually be met even while respecting the forces of nature.

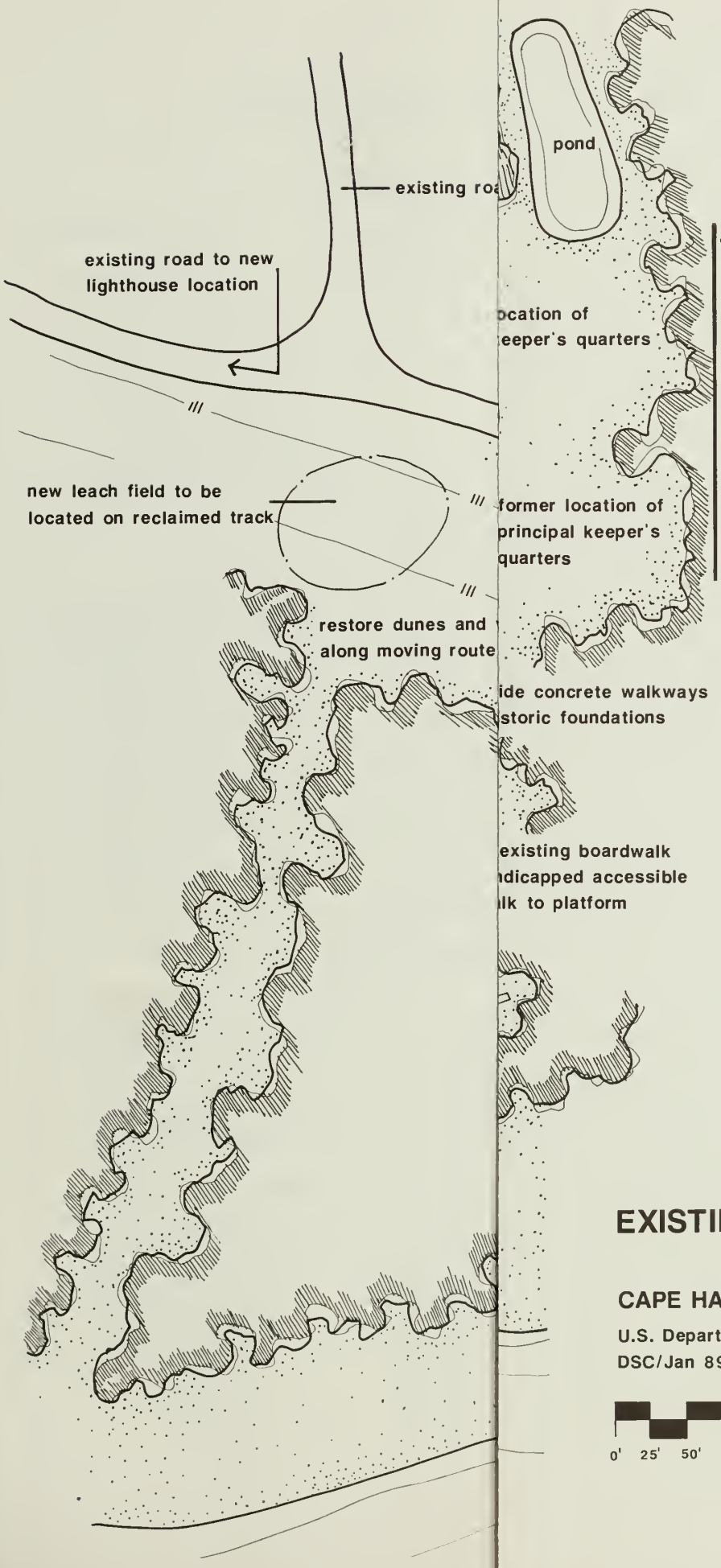
Interpretive Media

The process of moving the lighthouse and associated structures will be documented on film. Documentation should include interviews with scientists, engineers, park management, and other interested parties, so that a movie produced for public presentation will show the rationale for relocation. The film could have wide distribution because it will depict a bold response to a preservation problem. If the recently installed exhibits in the double keeper's quarters require rehabilitation and/or revision following the move, consideration should be given to accommodating the movie, perhaps a short version on video, in this building. Otherwise, the existing interpretive exhibits in the double keeper's quarters will remain unchanged at the new location.

The principal keeper's quarters will be furnished as a historic house museum.

After the move and structural repairs have been completed, and following the completion of visitor capacity studies on all structures, the lighthouse may be opened to the public once again. If the lighthouse cannot be reopened, or for the benefit of visitors who cannot climb the stairs, a video camera could be installed at the top, with a monitor at ground level, providing a vicarious experience for friends and relatives unable to ascend.

At the historic site of the lighthouse, wayside exhibits utilizing historic photos will show the building's location and interpret the move. A portion of the track installed to convey the structure will be left in place and interpreted with wayside exhibits. Estimated costs for interpretation are $253,000, including planning and design, project supervision, and contingencies. Total estimated project cost for the move, proposed site development, existing site reclamation, and interpretation is $8,775,000.



NOTES

- provide regulatory and information signs and interpretive exhibits including identification of former sites of four structures.
- parking lot expansion: south towards intersection. no expansion east towards shore or west towards pond. new parking must allow for site drainage away from pond.
- provide suitable protection for remaining historic resources, such as foundations and cisterns.

EXISTING SITE RECLAMATION

CAPE HATTERAS NATIONAL SEASHORE

U.S. Department of the Interior/National Park Service
DSC/Jan 89/603-40,070

0' 25' 50' 100' 200'

existing road to Route 12

existing road to new lighthouse location

redesign and expand existing parking for 120 spaces, for increased capacity and improved circulation. new parking will replace spaces obliterated by move and satisfy need for increased parking for recreational use.

pond

pond

former location of double keeper's quarters

obliterate existing service road

new leach field to be located on reclaimed track

former location of principal keeper's quarters

maintain open grassy area

restore dunes and vegetation along moving route

provide new comfort station with handicapped access. area should also include a water fountain, and exterior showers.

provide concrete walkways to historic foundations

former location of oil house

replace existing boardwalk with handicapped accessible boardwalk to platform

retain existing beach access

section of track to remain for interpretive purposes

former location of lighthouse

path

shoreline

southernmost groin

ATLANTIC OCEAN

NOTES

- provide regulatory and information signs and interpretive exhibits including identification of former sites of four structures.
- parking lot expansion: south towards intersection. no expansion east towards shore or west towards pond. new parking must allow for site drainage away from pond.
- provide suitable protection for remaining historic resources, such as foundations and cisterns.

EXISTING SITE RECLAMATION

CAPE HATTERAS NATIONAL SEASHORE

U.S. Department of the Interior/National Park Service
DSC/Jan 89/603-40,070

0' 25' 50' 100' 200'

ESTIMATED DEVELOPMENT COSTS, ALTERNATIVE 1

Development Item	Gross Construction Costs	Advance and Project Planning Costs	Total Project Costs
I. Move Structures			
Move lighthouse, including current site preparation, lighthouse repair and strengthening, rail/track, new foundation, move, site restoration, insurance, and contractor's profit.	$5,535,000	$1,056,000	$6,591,000
Move two keepers' quarters and oil house	327,000	63,000	390,000
Subtotal:	$5,862,000	$1,119,000	$6,981,000
II. Additional development at proposed site			
Paved parking for 110 vehicles	$187,000	$36,000	$223,000
Paved entrance road to parking (.1 mi)	72,000	14,000	86,000
Brick walkways (1,400 sq yd)	165,000	32,000	197,000
Grasscrete service road (850 sq yd)	62,000	12,000	74,000
Comfort station (400 sq ft)	118,000	23,000	141,000
Utilities (water, sewer, electrical)	155,000	30,000	185,000
Subtotal:	$ 759,00	$ 147,000	$ 906,000
III. Reclamation of existing site			
Paved parking for 120 vehicles	$ 204,000	$ 39,000	$ 243,000
Comfort station (400 sq ft)	118,000	23,000	141,000
Concrete walkways (533 sq yds)	35,000	7,000	42,000
Rehabilitate boardwalks (2,400 sq ft)	29,000	6,000	35,000
Obliterate service road (1,111 sq yds)	12,000	2,000	14,000
Utilities (water, sewer, electrical)	121,000	23,000	144,000
Miscellaneous site structures	13,000	3,000	16,000
Subtotal:	$ 532,000	$ 103,000	$ 635,000

Development Item	Gross Construction Costs	Advance and Project Planning Costs	Total Project Costs
IV. Interpretation			
Exhibits, principal keeper's quarters	$ 30,000	$ 6,000	$ 36,000
Furnishings, principal keeper's quarters	20,000	0	20,000
Documentary movie	150,000	29,000	179,000
Wayside exhibits	15,000	3,000	18,000
Subtotal:	$ 215,000	$ 38,000	$ 253,000
Total Project Costs:	$7,368,000	$1,407,000	$8,775,000

ALTERNATIVE 2: SEAWALL WITH REVETMENT

Alternative 2 is to construct a seawall around the base of the lighthouse coupled with a rock revetment to retard the erosional forces of the ocean. (See illustration for Alternative 2: Seawall with Revetment.) As with Alternative 1, the existing groinfield would remain in place with no further maintenance following the initial interim rehabilitation. The alternative is based upon a Corps of Engineers design prepared for NPS in 1985 and contains four elements: (1) a symmetrical octagonal reinforced concrete seawall rising 23 feet above sea level and 15 feet above grade; (2) a concrete sheetpile cutoff wall extending beneath the toe of the seawall to a depth of 16 feet; (3) an underground stone revetment fronting the cutoff wall and extending 208.6 feet seaward; and (4) a stone fill sloping upwards at a 25% grade from a point 48 feet from the base of the lighthouse to a concrete public walkway established below the inner edge of the seawall. Under this alternative the lighthouse and oil house would be enclosed within the seawall. The two distant keepers' dwellings would remain well beyond the wall. Each of the eight facets of the seawall would measure 129 feet long; the entire wall would be constructed 157 feet from the center of the lighthouse. Estimated construction cost of the seawall with revetment, including planning and design, project supervision, and contingencies, is $9,360,000. Construction would last 19 to 20 months. Cost of annual maintenance to protect the lighthouse over a 100-year period is very speculative, and estimates presented in the NAS report range from $11,000 to $540,000 per year.

Loss of Historic Integrity of Structures

At first, only the six seaward facets of the seawall would be constructed, although the subterranean sheetpile cutoff wall and revetment would be built to encircle the structure. The remaining area would provide public access until the encroaching sea forced construction of flood walls to ultimately seal the landward side. Eventually, as the ocean enclosed the revetted seawall, the lighthouse and oil house would become detached from the two keepers' quarters and their historical association would be lost. As the sea continued eroding the shoreline, the lighthouse and seawall would become an island and the associated structures would have to be relocated, additionally impairing the integrity of the historic relationship. Aesthetically, the lighthouse site would be further

ALTERNATIVE 2
SEAWALL WITH REVETMENT

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grade and obstructing the view of the lower part of the historic structure. The alternative also represents certain structural risk for the lighthouse by requiring de-watering and excavation of soils adjacent to the foundation to enable placement of the seawall and revetment. Other concerns include unknown projections of long-range reliability of the seawall-revetment against the forces of the ocean beyond 20-30 years, and substantial but undetermined maintenance costs. Perhaps most important, construction of the seawall/revetment would effectually preclude other options.

The possibility exists that prehistoric or historic archeological resources, whether or not associated with construction and use of the light station, may exist on the site. Construction of the revetment could destroy such resources not identified prior to construction. After this work is completed, any resources lying outside the revetment that have not been previously identified would be lost as the shoreline advances inland.

ALTERNATIVE 3: Rehabilitation of Groinfield with Revetment

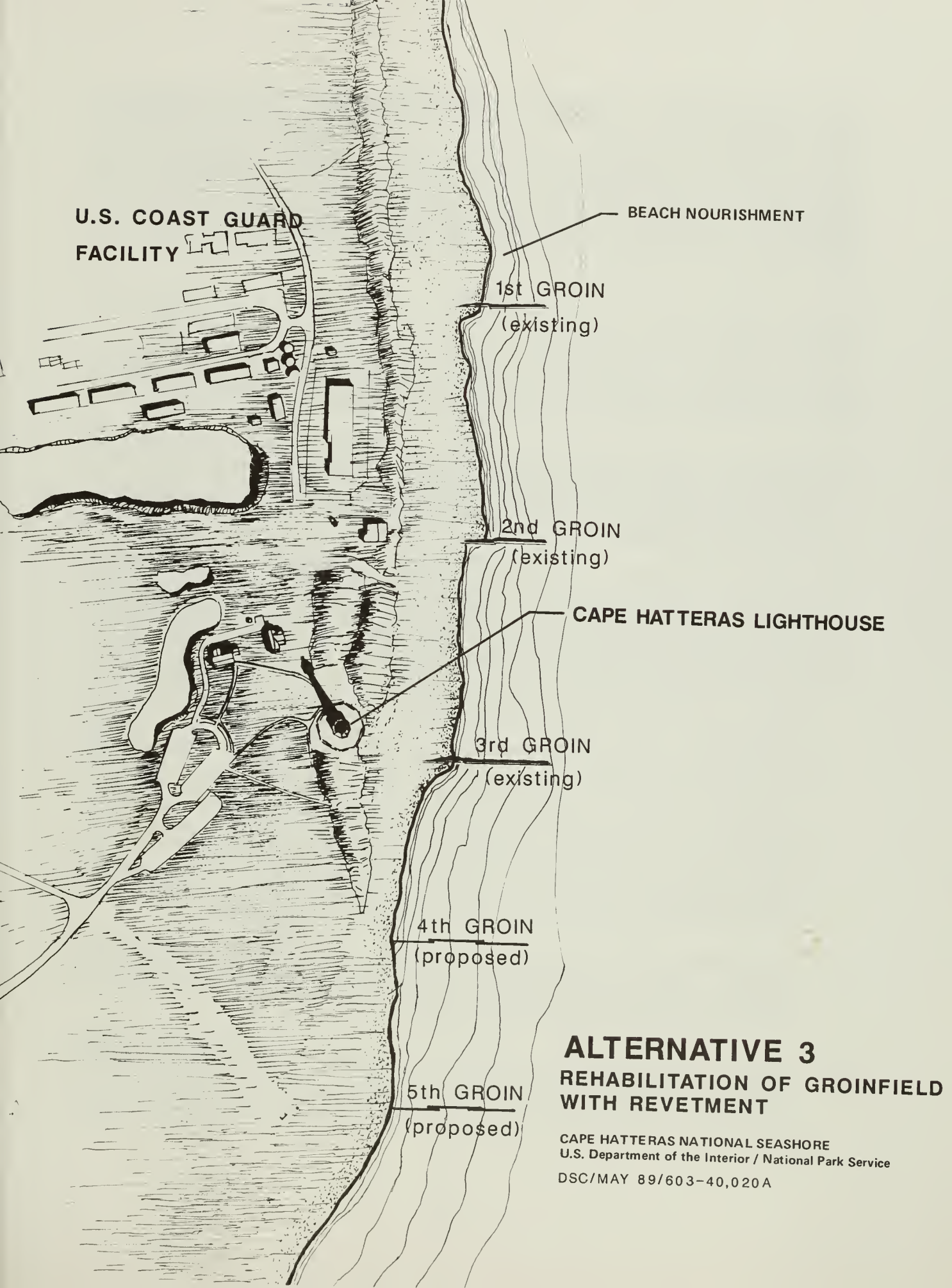
The present groinfield was installed along the beach fronting the lighthouse in 1969-70. (See illustration for Alternative 3: Rehabilitation of Groinfield with Revetment.) It consists of three steel groins projecting into the surf to stabilize the beach and prevent lighthouse from being battered by storm-produced waves. The northernmost two groins measure 530 feet each and exist 1200 feet and 550 feet, respectively, north of the lighthouse. The third groin measures 610 feet long and lies approximately 100 feet south of the lighthouse. This alternative would repair and shorten the existing groins while adding a fourth groin approximately 500 feet south of the third one, plus a fifth groin 500 feet below the fourth, to foster beach accretion in the area southeast of the lighthouse. In addition, 300,000 cubic yards of beach nourishment would be initially provided. The alternative would include the below grade construction of a reinforced concrete caisson-type revetment encircling the base of the lighthouse to further retard the undermining effects of waves driven by storm action. The revetment would consist of six 12-foot concrete segments cast in trenches and sealed at the joints. A horizontally placed reinforced concrete slab would cover the area between the top of the revetment and the base of the lighthouse. Dry rot to the timber gridwork supporting the structure would be forestalled by the placement of water recharging wells around the foundation. The alternative would also require initial and periodic beach renourishment.

Archeological resources not identified prior to construction of the caisson-type revetment could be damaged or destroyed during construction. Should the groins fail, the resulting erosion could also destroy any presently unknown archeological resources existing at the light station, whether prehistoric or historic.

Estimated cost of rehabilitating the groinfield, building the revetment, and providing beach nourishment is 9.7 million dollars, including planning and design, project supervision, and contingencies. Construction would last less than one year. The average annual maintenance cost to protect the lighthouse for 100 years is estimated at $310,000 per year.

Preservation Aspects

Promotion of beach accretion with additional groins would provide some protection against storm surges and waves, although it probably would not provide protection



ALTERNATIVE 3

REHABILITATION OF GROINFIELD WITH REVETMENT

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DSC/MAY 89/603-40,020A

against a major hurricane. Adoption of this alternative would, barring a major storm, provide a measure of protection for the lighthouse for a period of 20-30 years before major rehabilitation would again be required. The beach south of the groinfield would continue to retreat. Construction of the groinfield with revetment is considered to be a relatively short-term protective measure, and would be very expensive to maintain over a 100-year period. It would continue to impede the natural processes of coastal erosion. Furthermore, its enactment would postpone a decision bearing on the long-term preservation of the lighthouse complex and would increase the difficulty and expense of future relocation of the lighthouse.

OTHER ALTERNATIVES CONSIDERED

The three alternatives presented here represent the most feasible among a range of options considered for preserving the four structures comprising the lighthouse complex. Other alternatives were considered and rejected, as stated below:

(1) No action. This alternative would insure the ultimate loss of the lighthouse and destruction of the historic complex within a few decades, even sooner if a disastrous hurricane struck the Outer Banks. Unchecked erosional forces would promote deterioration of the timber mat foundation eventually leading to settlement and potential collapse of the structure.

(2) Incremental Relocation. The preferred alternative of the NAS study – incremental relocation, beginning with an initial move of 400-600 feet – was considered and rejected by NPS because the new location was expected to ensure protection for only 25 years instead of 100 years. Future moves, in the same direction as this document's preferred alternative, would ultimately be significantly more expensive than moving the lighthouse and associated structures over the longer distance all at once. For example, the total cost of moving all four structures the initial 500 feet, including planning and design, project supervision, and contingencies, is estimated at $5,109,000. Each additional 500-foot move is estimated to cost a total of $2,028,000 at today's prices, with no adjustment for future inflation. Thus, the cost for incremental relocation from the existing site to a 100-year protection site 2,500 feet away would total at least $13,221,000. This compares with $6,981,000 if the structures were moved the entire 2,500 feet at one time. In addition, the repeated disruption to the environment, visitor use, and park operations in the area would be greater for the incremental move alternative. Furthermore, potential damage to the structures from coastal processes just prior to each incremental move, as well as potential damage during each move due to numerous "start-ups" and "shut-downs" is greater than if the entire 2,500 feet was covered in one operation.

(3) Rehabilitation of the groinfield without revetment. This alternative provides only a short-term means for protecting the lighthouse and portends continuing and mounting maintenance costs as the groins require repair and replacement, and additional beach nourishment may be required.

(4) Construction of artificial reefs. Obstructions consisting of rubble mounds, concrete caissons, or other devices submerged in the ocean at various distances in front of the lighthouse would reduce wave energy, especially during severe storms, and foster beach accretion. The high wave energy of the shoreline at Cape Hatteras,

however, poses uncertainties of design, construction, functional longevity, and overall cost and effectiveness.

(5) Construction of offshore breakwaters with rehabilitation of the groinfield. Four visible rock-and-rubble breakwaters would be installed within 200 feet of the shoreline to work with the existing groins and one to be installed to the south. This short-term alternative would interfere with natural processes while presenting hazards for recreational use of the beachfront area.

(6) Installation of artificial seagrass. Commercially produced fabric seagrass would be placed in the surf zone to promote beach accretion and retard erosion. During the early 1980s this procedure was utilized several times at Cape Hatteras, but there was no evidence that it was singularly responsible for any period of beach accretion. The material was found unsuitable for the high energy wave action of Cape Hatteras. Artificial seagrass would thus not protect the lighthouse for an appreciable period.

(7) Continued beach nourishment by pumping sand from the vicinity into the area fronting the lighthouse. This option was deemed too costly based upon its anticipated recurrence and maintenance needs while the surrounding shoreline continued receding. Further, the almost permanent presence of heavy equipment required for pumping would serious compromise the setting and interfere with beach use.

(8) Construction inland of a new lighthouse. Although this alternative would preclude further construction on the beach and would allow for the unimpeded retreat of the shoreline, it would entail disregard of principles of historic preservation respecting the lighthouse and its associated structures. Moreover, reconstruction would be prohibitively expensive.

ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

The three alternatives proposed for the protection of the Cape Hatteras Lighthouse were developed to provide facilities necessary for a quality visitor experience and continued traditional use of the Cape Hatteras Lighthouse area.

ALTERNATIVE 1

As long as the groinfield remains in place, natural erosional processes will be obstructed. When the groinfield deteriorates to a condition of no longer being effective, the immediate area of the lighthouse will erode relatively rapidly, while the area south of the lighthouse will accrete until a relative state of equilibrium is reached. At that time the entire shoreline will again resume a westward migration at a more natural rate, probably less than 24 feet per year which occurred when the lighthouse was constructed, prior to artificial dune construction. Given historic erosional trends along the entire Cape Hatteras east coast, much of which has dune fields lending some protection against erosion, it is expected that this new westward migration will be slow enough so that the proposed location of the lighthouse 1,600 feet from the existing shoreline will insure its safety for the next 100 years. Of all the alternatives considered, moving the light station complex is expected to provide the highest probability for protection for 100 years.

Eventually, vegetation and wildlife habitat at the former site would be more naturally distributed, as would dunes and dune systems. The site for relocation of the lighthouse would be in vegetated sandflats and would avoid major wetland and maritime forested areas. This would keep the preferred alternative within the guidelines of the *General Management Plan/Development Concept Plan/Amended Environmental Assessment* of January, 1984.

The North Carolina Division of Coastal Management indicates that this alternative is consistent with their Coastal Zone Management (CZM) program, the major concern of which is that there should be no additional shore hardening. Any alternative proposing justifiable enhancement or rehabilitation of a groin already in place would probably receive a consistency determination from the state.

As it concerns cultural resources, relocation will obviously change the setting of the light station complex. It will remove the complex from its historical site and change its visual qualities with respect to its present surroundings from a sense of openness to one of vegetative enclosure. The configuration of structures to each other, as well as their historic orientation to the shoreline, will be maintained. The distance of the lighthouse from the shoreline will be approximately the same as when it was originally constructed. The separation of recreational and historic site activities will have a beneficial impact on the cultural resources. Overwash of the site is still possible during very large storms, but will be less likely to occur than at the present site. This should decrease the maintenance and repair work presently required. New foundations, slightly elevated, would eliminate the deterioration problems now present at the two keepers' quarters buildings. The preferred alternative has the greatest potential for disruption of archeological resources because it is the only one requiring development in a new location with attendant site preparation and visitor facilities.

ALTERNATIVES 2 AND 3

Alternative 2, seawall with revetment, would probably receive a consistency determination from the North Carolina CZM office because eventually the lighthouse site would become an island and no hardening of the shoreline would occur. It is possible that this island could act as a large groin, potentially causing adverse downcoast impacts. However, information received from the North Carolina CZM office indicates that this alternative would still be consistent with the state coastal management program. Alternative 3, rehabilitation of groinfield with revetment, would not be in compliance, because the addition of new groins is considered to be a hardening of the shoreline and therefore inconsistent with the CZM program.

In terms of cultural resources protection, alternative 2 would preserve the lighthouse and oil house while allowing the coastline to erode naturally. The setting of the lighthouse would change drastically as the seawall/revetment became an island separated from the two keepers' quarters. Eventually, the two unprotected structures would have to be moved to another site. Until then, they would continue to suffer damage from site overwash during storms. Loss of the context of the site and separation of the keepers' quarters from the lighthouse and oil house would greatly diminish the integrity of the complex. Further, this alternative would preclude other alternatives in the future should it be discovered that the revetment is being undermined.

Alternative 3 would allow the light station complex to remain in its original location. The new groins would not visually impact the complex because they are behind the dune and would not be visible from the complex at ground level. Should the lighthouse be opened to the public, the groins would be visible from the top of the structure. This alternative would slow, but not halt, ongoing shoreline erosion and ultimately would not protect the lighthouse complex from overwash and resulting deterioration. A major storm, such as a hurricane or a series of northeasters, could still topple the lighthouse and destroy the other structures. Alternative 3, while not directly affecting the structures of the complex, would in the long run be adverse because it would not appreciably prolong the existence of the complex without extremely high maintenance costs.

NO ACTION

No action would leave the complex in its present historical location. The groins currently existing would continue to provide some protection for the lighthouse. Overwash during large storms would continue to damage the keepers' quarters, causing increased maintenance problems and foundation repairs. There would continue to be the threat of loss of the lighthouse and/or other structures in the complex during a hurricane or during a series of powerful storms. Otherwise, all structures would eventually be lost to shoreline erosion.

COMPARISON OF ENVIRONMENTAL IMPACTS – CAPE HATTERAS LIGHTHOUSE PROTECTION

Area of Impact	Alternative 1 (Preferred): Relocation of the Lighthouse and Associated Structures	Alternative 2: Seawall with Revetment	Alternative 3: Rehabilitation of Groinfield with Revetment
Cultural Resources	Lighthouse and associated structure would be protected from damage by coastal erosion and storm surge for more than 100 years.	Greatest construction-related risk to the lighthouse of all alternatives due to extensive excavation required surrounding the foundation from dewatering. Lighthouse would be protected with relatively minor annual maintenance costs for 20-30 years. Protection for 100 years would require substantial but very uncertain maintenance costs. (Estimates range from $1.1 million to $54 million over 100 years.)	This alternative is considered to be the most "temporary" of the three alternatives. Lighthouse and associated structures would be protected as they are now with relatively minor annual maintenance costs for 20 years. Protection for 100 years would require substantial but very uncertain maintenance costs, including beach nourishment. (Estimates are as high as $31 million over 100 years.)
	Possible damage to structure may occur during move.	Associated structures would be unprotected from coastal erosion and overwash, and would have to be moved to be protected.	
	Original historic fabric of keepers' quarters, and artifacts therein, would be better protected from damage due to flooding.	Damage to keepers' quarters from flooding would continue.	Continued chance of damage to all structures from a major overwash event, and damage to keepers' quarters from routine flooding.
	Visual relationship between lighthouse and ocean would be lost.	Seawall surrounding base of lighthouse would obstruct view of the base and be an intrusion on the historic scene.	

Area of Impact	Alternative 1 (Preferred): Relocation of the Lighthouse and Associated Structures	Alternative 2: Seawall with Revetment	Alternative 3: Rehabilitation of Groinfield with Revetment
	Visual relationship among four structures in an open space would be maintained, but would be surrounded at perimeter by natural stand of trees and shrubs.	Lighthouse would become an island as shoreline continues to erode.	
	Foundation for all structures would be changed, thus altering historic fabric. Documentation of historic foundations would be performed to mitigate loss.	Presently unknown archeological resources may be disturbed in immediate area of lighthouse during construction and lost as shoreline migrates westward.	
	Foundations remaining in place would become archeological resources and would eventually be lost due to coastal processes.		
	Archeological resources associated with prehistoric use or historic use, such as Civil War or CCC camp, may be exposed during move and construction.		
	Other undiscovered archeological resources may be lost as shoreline migrates westward.	Similar to Alternative 1.	Similar to Alternative 1.
	Existing and proposed site, along with path of move, will be inventoried and evaluated for archeological resources. Remaining foundations will be appropriately protected.	Would be less need for ground disturbances at a new site, so that less archeological surveying and testing would be required.	Same as Alternative 2.

Area of Impact	Alternative 1 (Preferred): Relocation of the Lighthouse and Associated Structures	Alternative 2: Seawall with Revetment	Alternative 3: Rehabilitation of Groinfield with Revetment
Natural Resources	Coastal erosion will be retarded as long as groins are in place.	Similar to Alternative 1. In addition, Coastal erosion and migration will continue to occur and will migrate beyond lighthouse. Erosion rate may be accelerated at lighthouse by seawall.	Shoreline fronting the lighthouse and to the southernmost new groin will continue to remain relatively stable and show little or no westward migration.
	Approximately 10 acres of natural vegetation at new site would be cleared and topography smoothed.	Approximately 1 acre of dune environment in front of lighthouse will be removed permanently. If relocation is required for keepers' quarters, approximately 2 acres would be cleared at the new location.	Shoreline south of groinfield will continue to exhibit accelerated erosion due to sediment depletion.
	Approximately 4 acres of dune area and naturally vegetated area would be cleared and topography smoothed temporarily along route of move around lighthouse. Topography would then be reclaimed and revegetated.	New proposed parking lot would remove over 2 acres of dune environment.	Temporary loss of vegetation immediately surrounding lighthouse due to revetment construction, followed by revegetation.
	Approximately 1 acre of "pocket wetlands" interspersed over otherwise dry area would be filled in; wetlands may be reclaimed or allowed to reform.		Proposed parking lot would remove 2 acres of dune environment.
	Ten acres of deer habitat would be lost at new site.	Two acres of deer habitat would eventually be lost if keepers' quarters are relocated.	
	Four acres of deer habitat would be temporarily lost during move along the track route.		

Area of Impact	Alternative 1 (Preferred): Relocation of the Lighthouse and Associated Structures	Alternative 2: Seawall with Revetment	Alternative 3: Rehabilitation of Groinfield with Revetment
	Potential nesting sites for loggerhead turtles will be adversely affected from lighting and disturbance in the immediate area of the lighthouse during move. (There has been no such nesting in this area in the past 10 years.)	Greater impact on potential loggerhead turtle nesting sites than alternative 1, with continued impact during times of annual maintenance unless scheduled during non-nesting times.	Similar to Alternative 2.
Visitor Use and Interpretation	The existing site and adjacent beach will be closed to visitor access during relocation and reclamation, estimated at 3-6 months.	Existing site and adjacent beach will be closed to visitor access for a longer period of time than Alternative 1. Estimated to be 20 months.	Existing site and beach would be closed to public use for a time period similar to Alternative 1.
	Information and interpretation regarding the lighthouse and coastal processes will be told at two locations instead of one.	Interpretation will initially remain at one site, but will be modified to include discussion of the specific method of lighthouse preservation. Interpretation will eventually be provided at two sites when keepers' quarters are relocated.	Interpretive impacts are similar to Alternative 2.
		Interpretation of keeper's quarters would suffer due to structural deterioration caused by overwash, and/or eventual removal of structures to another site, thus separating them from lighthouse.	Same as Alternative 2.
	Competition for parking between recreational visitors and visitors to the historic site will be eliminated or significantly reduced.	Competition for parking spaces between recreational visitors and visitors to historic site will continue, although alleviated with additional parking.	Same as Alternative 2.

Area of Impact	Alternative 1 (Preferred): Relocation of the Lighthouse and Associated Structures	Alternative 2: Seawall with Revetment	Alternative 3: Rehabilitation of Groinfield with Revetment
	Adverse impacts to keepers' quarters from visitors carrying sand and saltwater will be eliminated or significantly reduced.	Same as Alternative 1 when keepers' quarters are relocated.	Same as Alternative 1 when keepers' quarters are relocated.
		Increased safety hazard to visitors climbing on seawall.	Continued safety hazard for swimmers in groinfield.
		Access to lighthouse will be lost when seawall is enclosed and lighthouse becomes an island.	
	Continued safety hazard for swimmers in groinfield.	Same as Alternative 1.	Same as Alternative 1.
Park Operations	Need for routine daily maintenance will increase because of operation of two sites. Need for cyclic repair and rehabilitation will decrease.	Continued high rate of routine maintenance and cyclic repair and rehabilitation.	Routine repair/rehabilitation mainten-ance requirements similar to Alternative 2.
	Need for cyclic repair and rehabilitation maintenance will decrease.	Additional staffing requirements for visitor protection and safety.	
	Need for visitor protection services should decrease due to expected reduction in visitor use conflicts.		
Policy and Compliance	Moving the lighthouse is considered to be consistent with the Coastal Area Management Act (CAMA) and NPS management policies for allowing natural processes to occur and for protecting historic resources.	Not as consistent with CAMA and NPS management policies with regard to natural processes and protection of historic resources as Alternative 1.	Same as Alternative 2.

Area of Impact	Alternative 1 (Preferred): Relocation of the Lighthouse and Associated Structures	Alternative 2: Seawall with Revetment	Alternative 3: Rehabilitation of Groinfield with Revetment
Costs for protection of lighthouse and associated structures against damage from oceanic processes.	Initial cost = $6,981,000*	Initial cost = $9,360,000	Initial cost = $9,663,000
	Annual maintenance cost = 0**	Estimated annual maintenance costs range from $11,000 to $540,000 averaged over a 100-year period.	Estimated annual maintenance costs of groin repair and beach nourishment are $310,000 averaged over a 100-year period.
	Approximately 1/3 of initial cost, or $2,000,000, is estimated to directly benefit the local labor/construction force.		

*Initial costs include planning and design, project supervision, and contingencies.

**Annual maintenance costs are estimated only for the ongoing costs of protecting the structures from damage due to overwash or coastal erosion.

Natural Resources Compliance

Coastal Zone Floodplains and Wetlands Management. Executive Orders 11988 "Floodplain Management" and 11990 "Protection of Wetlands" direct federal agencies to avoid development in floodplains and wetlands whenever there is a practicable alternative and to avoid, to the extent possible, adverse impacts associated with the occupancy or modification of floodplains and wetlands.

Because Cape Hatteras National Seashore was established to protect natural and cultural resources and to provide for water-oriented recreation, management and visitor use facilities are of necessity located within the national seashore, and in some cases lie in relatively close proximity to the ocean or sound. Since the entire national seashore is within the 100-year floodplain, and most of it is in the coastal high-hazard area, options for placement of the lighthouse outside the coastal high-hazard area or 100-year floodplain are nonexistent.

The movement and rehabilitation of existing structures in the 100-year floodplain and high-hazard areas will incorporate methods for protecting life and minimizing storm damage. No critical actions (e.g., storage of irreplaceable objects or documents) will occur in the 500-year floodplain. Flood proofing will be an important design criterion. The park staff will cooperate with municipal and state agencies to update the hurricane plan with respect to the new location of the lighthouse, support structures, and the new beach area that will replace the existing lighthouse visitor area.

There will be minimal impacts to wetlands with this proposal. The designated moving and relocation area of the preferred alternative contains "pocket wetlands" or swales (ephemeral low spots that very seldom have standing water, except during periods of rain) interspersed through a shrub thicket habitat. Although not often having standing water, these "pocket wetlands" do contain plants that usually inhabit aquatic environments, specifically *Cladium* (spp.), *Juncus* (spp.), and *Spartina patens*.

A certain amount of land clearing and leveling would need to be accomplished in order to relocate the lighthouse. The track route (area of the actual lighthouse movement) will temporarily impact a total of approximately 3.4 acres. Within this 3.4 acres are < 0.1 acres of "pocket wetlands." The relocation site, with parking, encompasses approximately 10.0 acres of which there exists < 0.25 acres of "pocket wetlands." Possible mitigation of these impacts could include (1) restoration of the track route to recreate, through surface contouring and marsh grass planting, a total wetland area equal to, or greater than, that lost to the project; and (2) creation of marsh areas at inlet spits or old ORV trails by revegetation with *Spartina*.

A statement of findings will be prepared that will document rationale for location of structures and facilities (temporary or long-term) within the floodplains and wetlands. This statement of findings will describe mitigating actions to protect life and property and to minimize environmental impacts.

Approval of the statement of findings by the NPS director is required prior to implementation of the plan.

The U.S. Fish and Wildlife Service's "Wetland Inventory Map" for Dare County, N.C., indicates that the track route for the lighthouse move passes through an area classified

as "E2557C" (esturine, intertide, evergreen/scrub-shrub, seasonally flooded). The U.S. Army Corps of Engineers will be contacted for permits when an alternative is chosen.

The NPS has reviewed North Carolina's coastal management program and has consulted with the state Division of Coastal Management concerning coastal zone management and the protection alternatives for the Cape Hatteras lighthouse complex development concept plan. Based on this contact, NPS believes that alternatives 1 and 2 will comply with the state coastal zone management program. Alternative 3, because it proposes new groins, would probably be found not to be in compliance with the program. The NPS will review the final proposal of the protection alternatives document for consistency with the state's coastal management program and will submit a formal consistency determination to the state, in accordance with the 1972 Coastal Zone Management Act, as amended, and its implementing regulations (15 CFR 930).

Endangered Species. The U.S. Fish and Wildlife Service and National Marine Fisheries Service advised that the species listed on page 15 might occur within the Cape Point/lighthouse area as transients or visitors, but are not known to use the area significantly enough to effect the project. Based on the determinations of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, NPS has determined that the proposed action will have no effect on endangered or threatened species, or critical habitat of these species, within the proposed project area. As requested by the National Marine Fisheries Service, the possible impacts to the listed species include: heavy use of the area by equipment and personnel that may deter the species from visiting the site; lights at the construction site (existing lighthouse site) may impact turtle nesting; and possible increased offshore activity (boating) that may be required during the move.

Other Considerations. The federally "under status review" plant species, *Lilaeopsis carolinensis* occurs in the pond by the existing lighthouse location and may occur in other wetlands in Buxton Woods. It is not known to occur within the relocation area. If the new parking lot, drainfield, and other development that may occur at the existing site threatens this vascular plant species, NPS needs to determine when this species is to be listed by the U.S. Fish and Wildlife Service and the mitigation that may need to be accomplished. Another species, *Trichostema sp*, currently does not have legal status, but is in the process of being classified as a North Carolina rare species. The move and new site development will impact this species.

Construction at the relocation site along with construction and rehabilitation of services at the existing beach site may have impacts on water quality. Since the freshwater table in this area of the seashore is so close to the surface, the construction of sewage drain fields at both sites, and parking lot construction and/or rehabilitation at both sites could impact the freshwater lens. Both of these facilities could end up being possible pollution sources.

The flow of freshwater (ground water) is thought to occur from the center of the island to the outer edges, although this has not been documented. Relocation may warrant the need to determine groundwater flow, at least in this area of the seashore.

At the existing site of the light station complex, a new drain field will be placed approximately 1000 feet from a significant wetland called Jeanette Sedge. This drain field will replace one located 150 feet from a small freshwater pond near the current visitor center. The abandonment of the current drain field and construction of one at the new site may be considered mitigation in and of itself. As a precaution, it is suggested

that groundwater test wells be installed and monitored for a specified period to assure compliance with state water quality regulations. Periodic septic tank inspections and possible pump outs would be other forms of assuring continued water quality. Dare County Health Department will need to review construction designs for septic tanks and drain fields under North Carolina Administrative Code, Title 10, Department of Human Resources, Chapter 10, Health Services; Environmental Health, Subchapter 10A, .1934-.1968.

Construction of the new parking lot and rehabilitation of the existing lot should include specific design criteria that will allow parking lot drainage over a wide area. This will minimize the chances that rainwater drainage, possibly contaminated with oil, grease, coolants, antifreeze etc., will be concentrated as runoff into one area. Review of the design criteria for the parking lots needs to be sent to North Carolina Division of Environmental Management, under Title 15 North Carolina Code 2H.1000 – Storm Water Regulation for Runoff of Impervious Areas.

The uncontrolled use of water for construction on a project this large may lower the freshwater lens in this area of the island. Specifications on all contracts will be written to limit groundwater use to the minimum practical.

The grading activity that will clear both the track route and the new site location will proceed on permission from the state. All land clearing or ground disturbances of more than one acre are regulated by state permit from the North Carolina Division of Land Resources, Land Quality Section under North Carolina Sediment Pollution Control Act of 1973 (NCGS 113A-50 to 66).

There will be no effect from the proposal or alternatives on prime or unique farmland soils, since none exist at the sites.

Cultural Resources Compliance

The Cape Hatteras lighthouse complex is listed on the National Register of Historic Places.

In 1983 a Memorandum of Agreement was concluded among the North Carolina State Historic Preservation Officer, the Advisory Council on Historic Preservation, and NPS. That document, sanctioned by the National Historic Preservation Act of 1966, as amended, was based on NPS's conclusion that a seawall/revetment combination best met the requirements of Cape Hatteras National Seashore for preservation of the Cape Hatteras lighthouse complex. Construction was to occur after fulfillment of all four stipulations in the Memorandum of Agreement and documentation of actions in an Assessment of Effect (XXX) form.

Since selection of that alternative, the NAS committee evaluated other options and concluded that the only one that would protect the lighthouse complex with any degree of long-term certainty would be that proposing its relocation inland. Based on the NAS data, NPS has re-evaluated its position and concluded that moving the lighthouse complex is its preferred option.

CONSULTATION AND COORDINATION

State, Region, and Local

North Carolina Division of Coastal Management
North Carolina State Clearinghouse, Department of Administration
North Carolina Division of Land Resources
North Carolina Division of Environmental Management
North Carolina Department of Agriculture, Plant Conservation Program
North Carolina Department of Natural Resources and Community Development
North Carolina State Historic Preservation Officer
Dare County Health Department

Federal

Advisory Council on Historic Preservation
Army Corps of Engineers
Federal Emergency Management Agency
National Marine Fisheries Service
U.S. Fish and Wildlife Service

PLANNING TEAM

DENVER SERVICE CENTER

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Jeffrey E. Heywood, Co-Team Captain, Landscape Architect
Michael S. Bilecki, Natural Resources Compliance Specialist
L. Craig Cellar, Cultural Resources Compliance Specialist
Mark Pritchett, Landscape Architect
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APPENDIX

United States Department of the Interior

NATIONAL PARK SERVICE
SOUTHEAST REGIONAL OFFICE
75 Spring Street, S.W.
Atlanta, Georgia 30303

IN REPLY REFER TO:

MEMORANDUM OF AGREEMENT

WHEREAS, the National Park Service (NPS), has determined that the correction of the erosion problem at Cape Hatteras Lighthouse, North Carolina, will have an effect upon the Cape Hatteras Lighthouse District, a property included in the National Register of Historic Places and has requested the comments of the Advisory Council on Historic Preservation (Council) pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. 470f) and its implementing regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800),

NOW, THEREFORE, the NPS, the North Carolina State Historic Preservation Officer (SHPO), and the Council agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on the Cape Hatteras Lighthouse District.

Stipulations

The NPS will ensure that the following measures are carried out:

1. NPS will contact the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) to determine the level of documentation required to record the Cape Hatteras Lighthouse in its present condition, setting and appearance. All documentation must be completed and accepted by HABS/HAER prior to the start of construction of the revetment.

2. Prior to construction, engineering drawings and details of construction (plans and specifications) of the revetment will be submitted to the North Carolina SHPO for review. Should the SHPO object within 30 days to any plans or specifications provided pursuant to this Memorandum of Agreement, the agency official shall consult with the SHPO to resolve the objection. If the agency official determines that the objection cannot be resolved, the agency official shall request the further comments of the Council pursuant to 36 CFR Section 800.6(b).

3. Within three years of ratification of this Agreement, NPS, in consultation with the North Carolina SHPO, will develop a preservation plan for each structure of the Lighthouse complex. Each plan will discuss alternative uses for each structure, and include both interim and final treatment plans and a schedule for implementation of actions for the structures. All rehabilitation work discussed in the plan will be planned in accordance with NPS-28. The preservation plans will be submitted for review and comment to the North Carolina SHPO. All comments from the North Carolina SHPO will be incorporated into the plans.

4. NPS will continue to investigate and test alternatives to the construction of the revetment that might reduce both the existing erosion problem and the proposed adverse effect on the Lighthouse complex. If it proves feasible to implement such alternatives, the revetment will not be constructed or will be reduced in scale and dimension. Prior to any change in the proposed course of action, the North Carolina SHPO and the Council will be given an opportunity to comment.

Execution of this Memorandum of Agreement evidences that the NPS has afforded the Council a reasonable opportunity to comment on the undertaking and its effect on historic properties and that the NPS has taken into account the effects of its undertakings on historic properties.

(date) 1/19/83
Regional Director
National Park Service

William S. Price Jr. (date) 1-31-
North Carolina State Historic Preservation Officer

Robert Stanley Feb 14, 1983
Executive Director
Advisory Council on Historic Preservation

(date) 2/15/83
Chairman
Advisory Council on Historic Preservation

U S GOVERNMENT PRINTING OFFICE: 1989—673-038 80,025 REGION NO 8

COMMENTS

This public response form is provided to make it easy for you to comment on our alternatives for saving the Cape Hatteras lighthouse and associated structures. For your convenience, the form is self-addressed and postpaid. Please return your comments within thirty days. We welcome your thoughts and encourage your continued interest in the future of the Cape Hatteras lighthouse complex.

tape

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Superintendent
Cape Hatteras National Seashore
Route 1, Box 675
Manteo, North Carolina 27954

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As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Publication services were provided by the graphics staff of the Denver Service Center.
NPS D-47 June 1989